Powerline Ethernet Adapter

PowerGrid 902

User Manual

UK type

COMTREND

Introduction

This user manual provides practical information for the installation, operation and application of the device. It is suitable for those with little or no networking experience, although some advanced topics are also covered.
A glossary of acronyms is included in Appendix A for reference.

Save Our Environment

This symbol means that when the equipment has reached the end of its useful life, it must be taken to a recycling centre and processed separate from domestic waste.

The cardboard box, the plastic contained in the packaging, and the parts that make up this device can be recycled in accordance with regionally established regulations.

Never throw this electronic equipment out along with your household waste. You may be subject to penalties or sanctions under the law. Instead, ask for instructions from your municipal government on how to correctly dispose of it. Please be responsible and protect our environment.

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Chapter 1 - Introduction

This user guide provides details concerning the installation, configuration and application of COMTREND Corporation's PowerGrid 902 Powerline adapter.

The PowerGrid 902 is the first of its kind to incorporate an AC filter with rear socket. It allows for the connection of the adapter to the electrical grid of a home without depriving the user of a single power outlet.

The PowerGrid 902 is the physical link between Powerline and Ethernet (10/100M) networks. The design is such that, on the one hand, it avoids limiting a power socket to just PLC purposes, and on the other hand, provides a filtered power socket to avoid interference from appliances connected to it.

The front panel of the PowerGrid 902 has two buttons and three LEDs that allow the user to configure a secure PLC network without the use of a computer. The Status LED shows the available level of data throughput in the application layer.

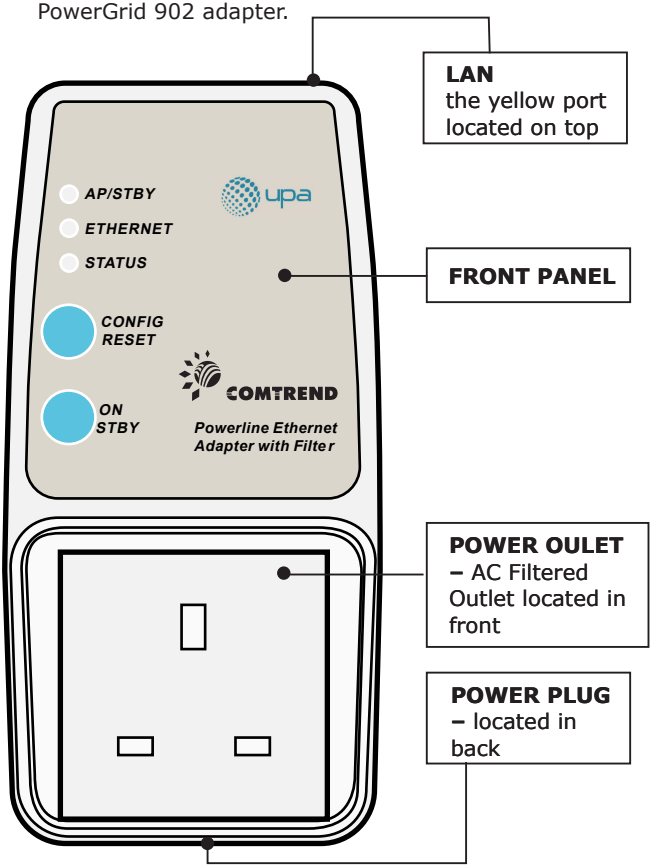
SPECIAL FEATURES

- ☐ **One Button Security Setup** - Automatic generation of an Encryption Key and Network Identifier by pressing a single button!
- ☐ **Throughput Indicator** - A tri-color Status LED that shows estimated data throughput in the application layer
- ☐ **Rear Socket with AC Filter** - Plug the PowerGrid 902 into a power outlet without losing use of the outlet for other applications.

Chapter 2 - Basics

2.1 Device Layout

The following figure shows the physical layout of the PowerGrid 902 adapter.



2.2 Front Panel

This table provides descriptions of the front panel buttons and LEDs.

Button	Function
CONFIG/RESET (Security Setup / Factory Reset)	Press for "One Button Security Setup". Holding down the button for a long period will result in a "Factory Reset".
ON/SBY (Power ON / Standby button)	Used to switch the adapter between **ON** and **STANDBY** (Power Saving) modes. Turning off the adapter will also set the "Status" & "Ethernet" LEDs to "off"
LED	**Function**
STATUS*	• Red: Adapter is ON. If PLC link, Estimated Application Throughput < Threshold 1 (6Mbps). • Orange: if PLC link, Threshold 1 (6Mbps) < Estimated Application Throughput < Threshold 2 (12Mbps). • Green: if PLC link, Estimated Application Throughput > Threshold 2 (12Mbps) • BLINKING (in RED, ORANGE or GREEN): Traffic in the Ethernet port.
ETHERNET	• Green On: LAN connection established. • Off: LAN connection is not established. • Blinking: Data transmitting/receiving
AP/STBY	• Red: Adapter in Standby mode. • Green (steady): Fixed AP (access point). • Green (blinking): Fixed AP is searching. • Off: Adapter in EP (End Point) mode. • 3 Flashes: EP has exchanged keys with AP

* see Chapter 4 – Network Performance for more details.

2.3 Default Settings

The factory default settings are presented below.

- Network Mode is AP (Public)
- IP Configuration is DHCP
- MAC Type is In-Home AV
- Node type is End Point

- Configuration password = admin
- Factory Reset password = admin

- Fixed IP address = 10.10.1.69
- Fixed IP subnet mask = 255.255.0.0
- Default Gateway IP address = 192.168.1.105

NOTE: These configuration settings can be customized using a web browser. For further instructions, see Chapter 5 - Web User Interface. To return the adapter to factory default settings, follow the FACTORY RESET procedure in the Troubleshooting section of this manual.

Chapter 3 - Quick Setup

PowerGrid 902 units are configured by default with flexible network settings.

As a result, when they are plugged into the power mains of a home they will connect to an already existing PowerGrid network. If there is no existing network they will create a new network that will operate smoothly but without enhanced security features.

This is why it is recommended to reconfigure your PowerGrid 902 units to form a secure network (with a unique network identifier and encryption key). This can be accomplished using just the front panel buttons on the PowerGrid units. The following sections describe how to setup a secure network in this way.

> **NOTE:** You will need a single PowerGrid 902 unit and Ethernet cable for each computer, or other device, that you wish to connect to the Internet.

3.1 Internet Connection

The steps below show how to connect a PowerGrid 902 unit to your modem.

1. Turn on your modem and wait for the Internet connection to become active.

2. Plug a PowerGrid 902 unit into the power socket closest to the modem as in figure 1 (at right). The Status LED on the front panel of the unit should light up RED.

3. As in figure 2, connect the PowerGrid 902 unit to the LAN port of the modem

Fig. 1

with an Ethernet cable. The ETHERNET LED on the unit should light up GREEN.

Fig. 2

AP UNIT CONFIGURATION

A PowerGrid network consists of one AP (Access Point) unit connected to multiple EP (End Point) units. The AP unit controls access to the Internet and connects the EP units to the network. Follow step 4 (below) to configure the AP unit.

4. As shown in figure 3, press the CONFIG/RESET button on the PowerGrid 902 unit. Wait for the AP/STBY LED to start blinking and then release it. Wait another thirty (30) seconds until it stops blinking and check the AP/STBY LED.

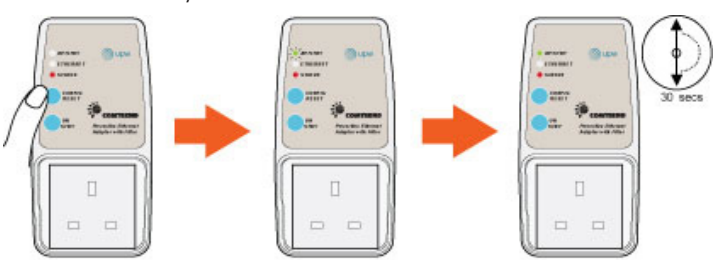


Fig. 3

If the AP/STBY LED is now ON, then setup was successful and you can now proceed to section 3.2, where you will configure the EP unit.

If AP/STBY LED is now OFF, or just keeps blinking, you must first press the CONFIG/RESET button for 15 seconds to reset the unit and repeat step 4.

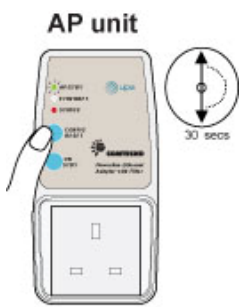
After several attempts, if the AP/STBY LED does not stay ON, then disconnect the PowerGrid 902 unit from the modem and the power socket, choose another unit and repeat the process from step 2.

If all else fails, contact your supplier or service provider for further assistance.

3.2 Computer Connection

The steps below show how to connect a PowerGrid 902 unit to your computer.

1. Turn on your computer.
2. Plug a PowerGrid 902 unit into the power socket closest to the computer. The Status LED should light up RED, as in figure 1.
3. Connect the PowerGrid 902 to the computer with an Ethernet cable, see figure 3. The ETHERNET LED on the unit should light up GREEN.



▲ Fig. 5

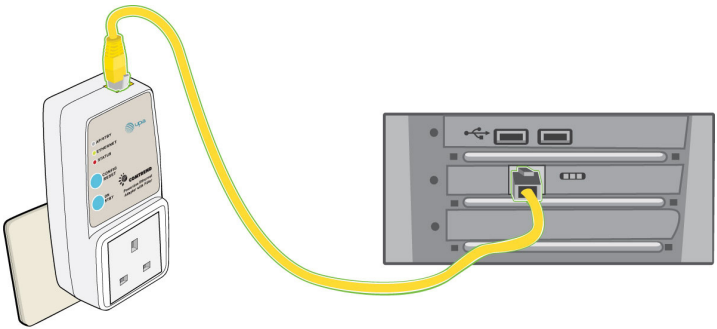


Fig. 4

EP UNIT CONFIGURATION

As previously discussed, a PowerGrid network can have only one AP unit. This unit was configured in section 3.1. All other units must be set as EP units.

To do so, follow these steps:

4. As shown in figure 5, press the CONFIG/RESET button on the AP unit until the AP/STBY LED starts blinking and then release it. You now have thirty (30) seconds to complete the EP set up.

5. Before the AP unit AP/STBY LED stops blinking, press the CONFIG/RESET button on the PowerGrid 902 that you wish to configure as an EP unit. Wait for its AP/STBY LED to start blinking and then release the button. After a few seconds, the AP/STBY LED should flash quickly three times and then turn OFF, as shown in figure 6.

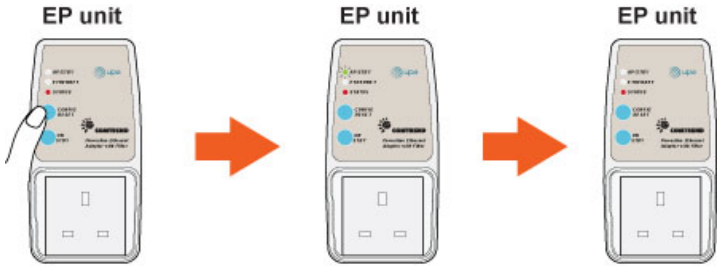


Fig. 6

If the AP/STBY LED of the **EP unit** is now **OFF**, then proceed to step 6.

If the AP/STBY LED of the **EP unit** is now **ON**, or just keeps blinking, you must press CONFIG/RESET for 15 seconds and then return to step 4.

After several tries, if the AP/STBY LED of the EP unit does not remain **OFF**, then disconnect it from its power socket and from the computer, or other device. Select another EP unit, if possible, and repeat the process from step 2.

If all else fails, contact your supplier or service provider for further assistance.

6. After adding the **EP unit** to the PowerGrid network, check that the AP/STBY LED on the **AP unit** has stopped blinking and remains ON, as in figure 7.

Fig. 7

If the AP/STBY LED on the **AP unit** is now **OFF**, or just keeps blinking, you must first reset the unit and then try again. To reset the unit, press CONFIG/RESET for 15 seconds. Then return to step 4 in section 3.1 and repeat section 3.2 for every device you wish to add to the network.

After several tries, if the AP/STBY LED

on the **AP unit** does not stay ON, then disconnect it from the modem and its power socket, choose another unit to be the AP unit and repeat the entire process starting from section 3.1, step 2.

If all else fails, contact your supplier for further assistance.

7. If the AP/STBY LED on the **AP unit** is now **ON**, then you have completed the setup successfully.

   CONGRATULATIONS!

   You can now either:

   ➢ Add another computer to the network by repeating steps 1-6

OR

➢ Stop here and start enjoying your secure PowerGrid network!

NOTE: These PowerGrid 902 units keep their network security settings even after losing power, so that you don't need to reset the network, when moving network devices or even after a power outage!

Chapter 4 - Network Performance

The Status LED shows the estimated available level of throughput in the application layer.

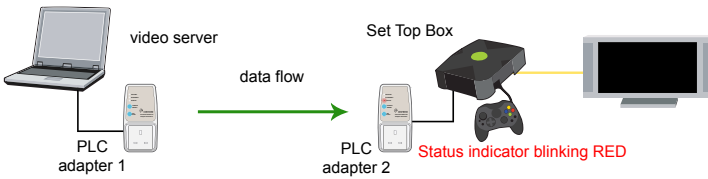
There are three levels of throughput indicated by three different LED colours. A particular adapter shows, with one colour, the throughput level with reference to the adapter sending the most data to it. In the case of a network consisting of two adapters, they always show the level of throughput with reference to the other. However, in the case of a network of three or more adapters, each one internally measures the amount of bytes received from the other adapters in the network and only shows the level of throughput with reference to the one that is sending the most data.

A throughput estimator also keeps track of the number of neighbouring networks since available bandwidth will be divided between them when sharing the PLC channel. The thresholds for these levels of throughput are preconfigured in the system as shown below.

LED	STATUS
RED	Estimated Throughput < Threshold 1 (6Mbps)
ORANGE	Threshold 1 (6Mbps) < Estimated Throughput < Threshold 2 (12Mbps)
GREEN	Estimated Throughput > Threshold 2 (12Mbps)
BLINKING (in any color)	Traffic in the PLC port (for each estimated throughput level)

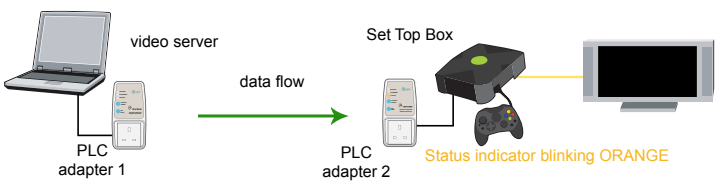
4.1 Point-to-Point Network

- **CASE 1**: Estimated throughput is less than 6 Mbps. The PLC channel is not able to transmit an SDTV channel. The STATUS LED will be RED as shown in the following figure:



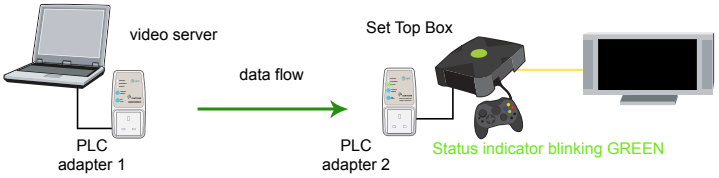
Estimated throughput < 6 Mbps

- **CASE 2**: Estimated throughput is greater than 6 Mbps but less than 12 Mbps. The PLC channel is able to transmit an SDTV channel, but not two SDTV channels simultaneously or one HDTV channel. The STATUS LED will be ORANGE as shown in the following figure:



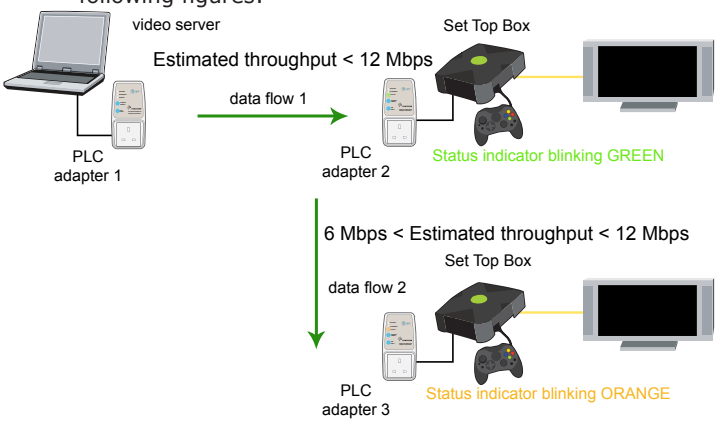
6 Mbps < Estimated throughput < 12 Mbps

- **CASE 3**: Estimated throughput is greater than 12 Mbps. The PLC channel is able to play at least two SDTV channels or 1 HDTV. The STATUS LED will be GREEN as shown here:



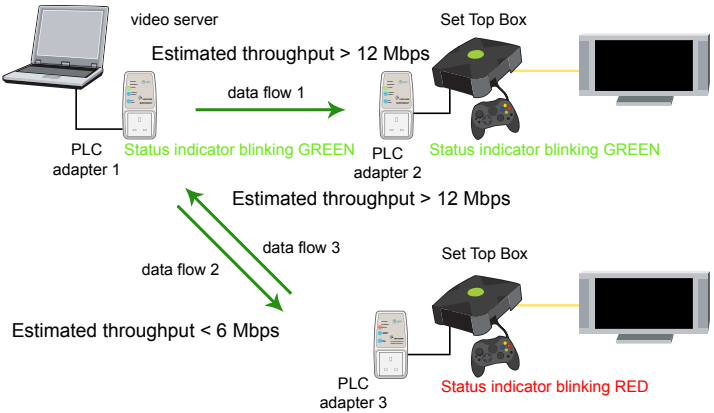
4.2 Point to Multipoint Network

In the case where the PLC network is composed of three or more adapters, similar situations could arise as with a point-to-point network. These are illustrated in the following figures:



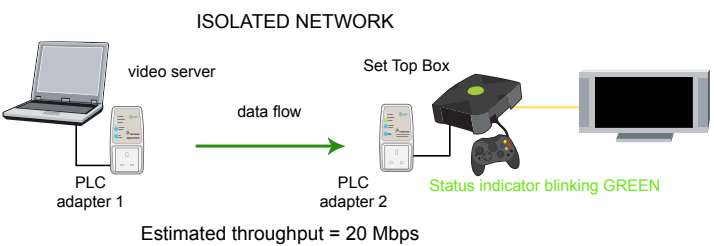
The STATUS LED in each adapter will show the estimated level of the PLC link from which it is receiving the most amount of traffic at any given time. The status LED in PLC adapter 3, for example, could be showing a level of throughput available from PLC adapter 2 for a period of time as illustrated in the figure above. However, traffic flow could change through user intervention and then

the status LED in PLC adapter 3 could show the level with reference to the PLC adapter 1 link, as shown in the following figure.



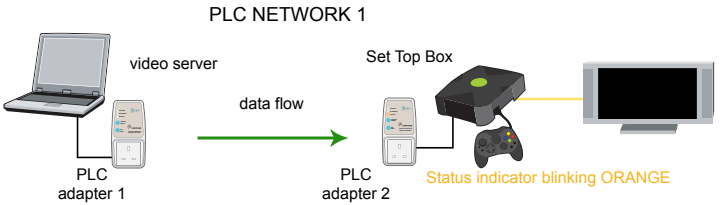
4.3 Neighboring Networks

The Status LED also takes into account the possibility of having neighbouring networks. In such a case, the throughput evaluator will divide the available bandwidth in two when there is visibility between any two networks since the PLC channel must be shared on a time basis. In the following figure, an example of an isolated network is first shown.

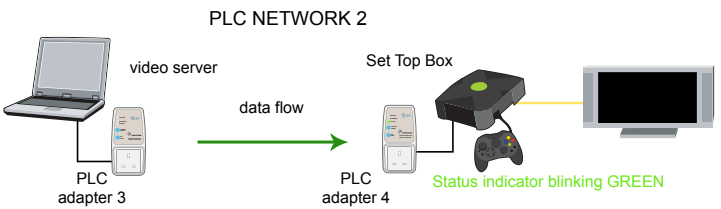


In the next figure, the previous network (network 1)

sees a new neighbouring network (network 2), and a new evaluation of throughput is made to show the user that channel conditions have changed and available bandwidth has decreased:



Estimated throughput = 20 Mbps / 2 = 10 Mbps



Estimated throughput = 30 Mbps / 2 = 15 Mbps

Chapter 5 - Web User Interface

The web-based user interface (WUI) provides information about your PowerGrid 902 units and can also be used to configure or reset their settings.

The WUI is accessed using a JavaScript enabled web browser, such as Microsoft Internet Explorer. The instructions that follow assume the PowerGrid network has been configured correctly (i.e. according to the instructions in Chapter 3 or the QIG) and that the host computer is running Windows XP.

NOTE: The process described in the following sections will work for any operating system (OS), but the specific steps will need to be adjusted to match your particular computing environment.

5.1 IP Configuration

Before using the WUI, you first need to adjust the IP configuration of the host PC. This is a two-step process addressed in subsections 5.1.1 and 5.1.2.

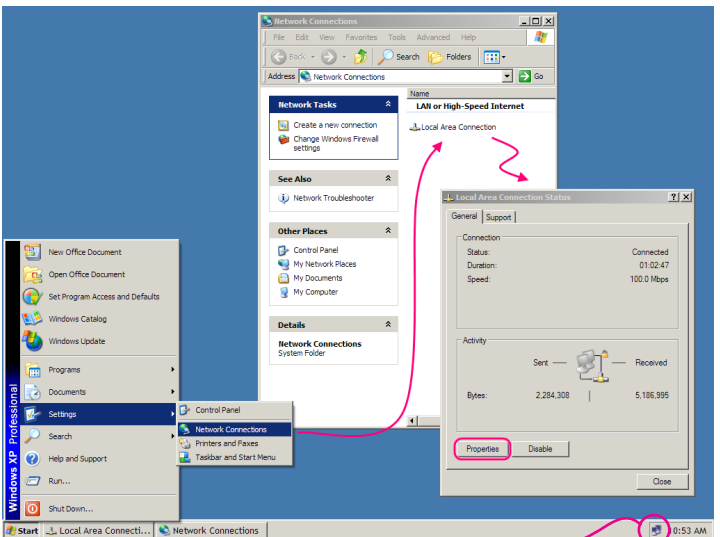
FYI: The IP configuration defines the location of your computer within the network using Internet Protocol (**IP**) addressing. Your computer needs an IP address so it can receive and send information on the network. In **Fixed IP** mode you assign this IP address yourself; while in **DHCP** mode it is assigned automatically by a DHCP server.

5.1.1 Fixed IP

The following instructions describe how to change the IP configuration of your computer to **FIXED IP** mode, so that you can access the WUI.

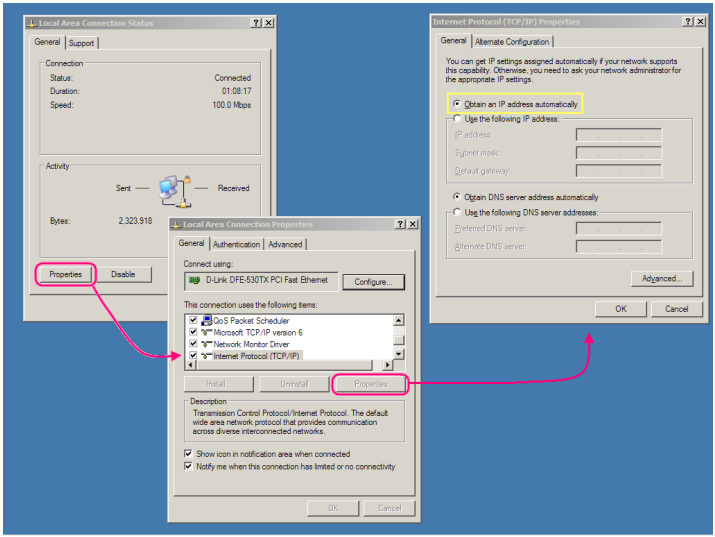
STEP 1: Turn on your computer (and login, if necessary).

STEP 2: From the desktop (as shown below), click on the **Start** button and select **Network Connections**. Next, double-click **Local Area Connections** to open its window and then click the **Properties** button.



NOTE: You may also access this window by double-clicking the Local Area Connection icon on your taskbar.

STEP 3: Select **Internet Protocol (TCP/IP)** and click the **Properties** button.

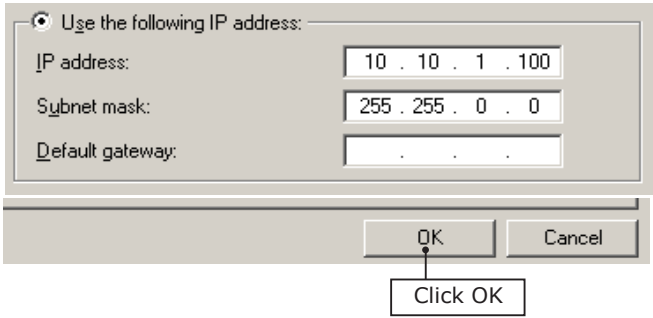


STEP 4: Check the settings in the **Internet Protocol (TCP/IP) Properties** dialog box (shown on the far right in the figure above). Make sure to record all the settings you see here, as you will need to reset them later.

STEP 5: If the "Obtain an IP address automatically" radio button is selected, then your PC is configured in **DHCP** mode. In this case you should select the "Use the following IP address" radio button instead.

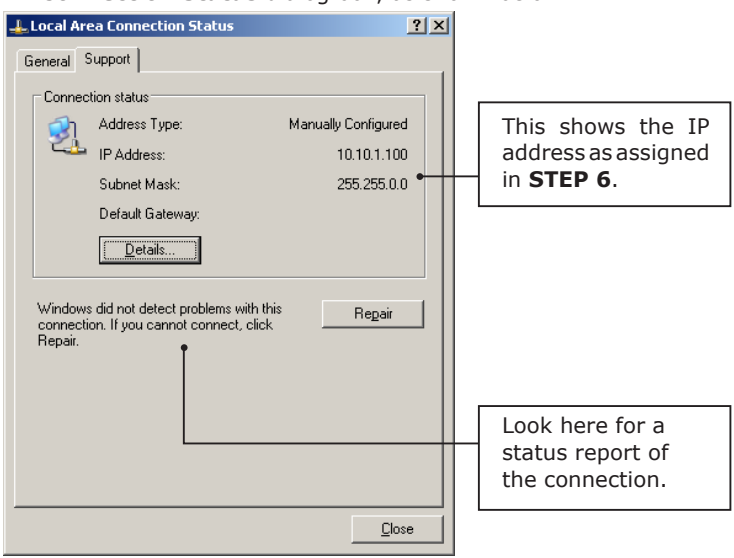
If it is not selected then your PC is already in **FIXED IP** mode.

STEP 6: Change the **IP address, Subnet Mask** and **Default Gateway** to match those values shown in the figure below and click the **OK** button.



STEP 7: Close the previous two windows. Since you made changes, click **OK**, but not Cancel! You then must wait for the LAN connection to reset.

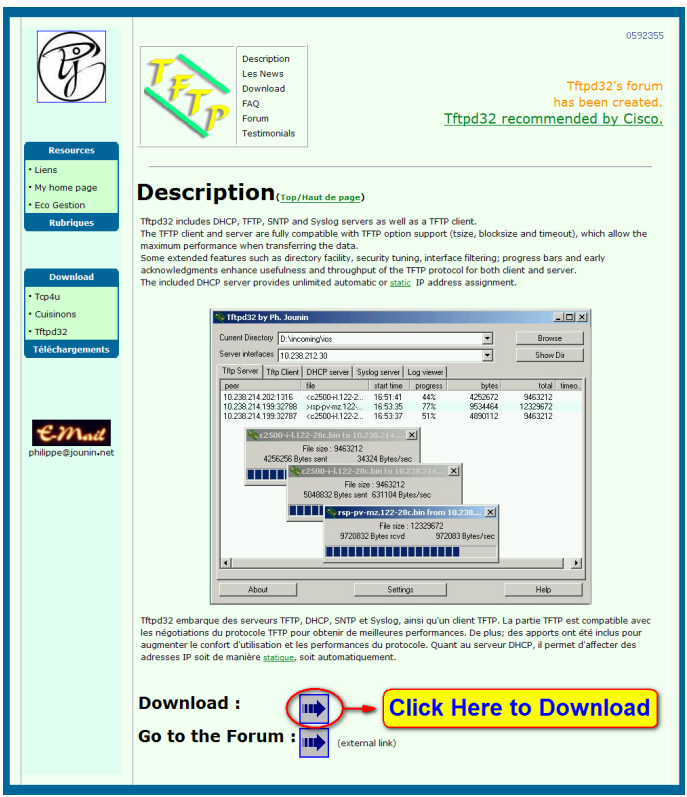
After the connection recovers, you should check the connection status on the support tab of the **Local Area Connection Status** dialog box, as shown below.



5.1.2 DHCP Server

Now that we have configured the computer IP configuration, we now need a DHCP server to provide IP addresses to the PowerGrid units.

We recommend using TFTPd32, which is free software you can use for this purpose. It is available on the Internet at http://tftpd32.jounin.net. A screenshot of the website is shown below with the download link indicated.

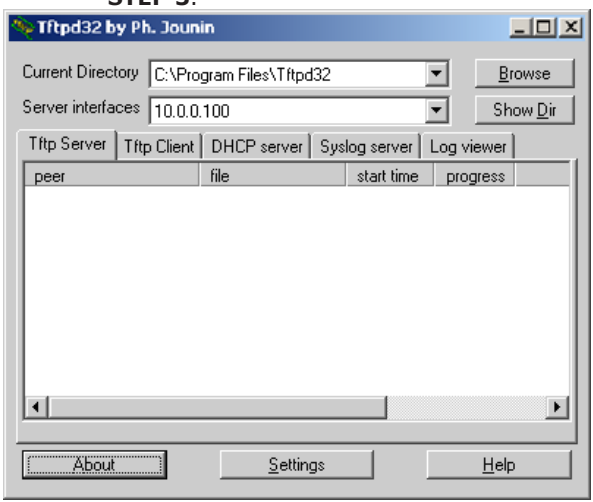


Once you have downloaded and installed this software please proceed with the instructions on the next page:

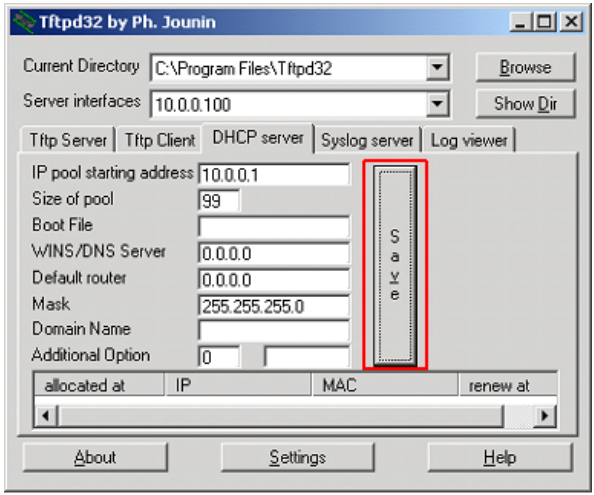
STEP 1: There should now be a new *TFTPd32 program icon* on your desktop or in the All Programs folder found in the Windows START menu. Open TFTPd32 by clicking this icon.

STEP 2: Various functions are accessible from tabs in the Tftpd32 window. The Tftpd32 window shown below has Tftp Server, Tftp Client, DHCP server, Syslog server and Log viewer tabs.

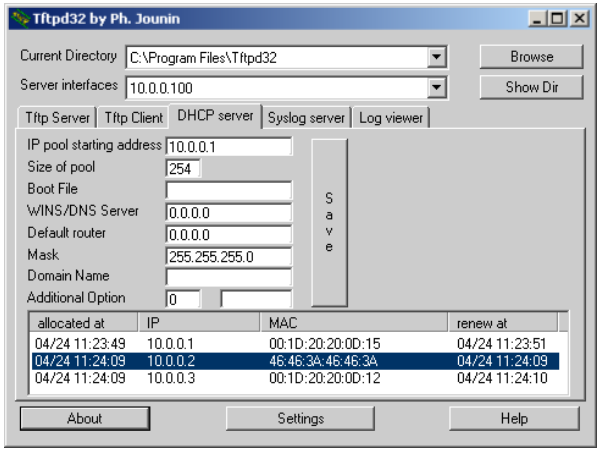
Select the **DHCP server** tab and continue to **STEP 3**.



STEP 3: To configure the DHCP server, copy the settings as shown below. When finished, click the Save button (outlined in red) and close Tftpd32 with the small 'x' located in the top right corner of the window.



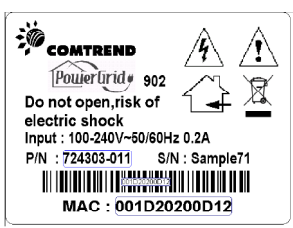
STEP 4: Restart Tftpd32 and return to the DHCP server tab, as shown. You will now (or very soon) see several items listed in the box at the bottom. Look for any devices with a MAC address starting with "00:1D:20".



In the example above, there are two PowerGrid units:

- ☐ MAC address: 00:1D:20:20:0D:15 with an IP of 10.0.0.1
- ☐ MAC address: 00:1D:20:20:0D:12 with an IP of 10.0.0.3

Every PowerGrid 902 unit has a small label on the plug-side of the unit, with its MAC address listed under the product bar code, as shown at right. Match the MAC address of the unit you wish to access with its IP address.



You can use this IP address to access the WUI for that unit, as described in section 5.2 Login Screen.

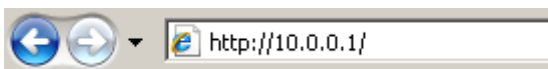
NOTE: If you find any PowerGrid 902 units are missing from this list, they may have previously acquired an IP address from the DHCP server on your router. In this case, disconnect

your router from the network and reset the affected units (by holding down the CONFIG/ RESET button for 15 seconds. You may also need to close and restart the Tftpd32 program to make the DHCP server search once more for the missing units.

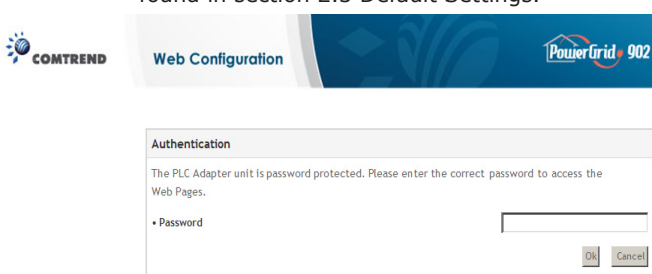
5.2 Login Screen

Perform the following steps to login to the WUI:

STEP 1: Start the Internet browser and enter the IP address as a HTTP link in the URL address field and press Enter. For the IP address of 10.0.0.1, you must enter http://10.0.0.1, as shown below.



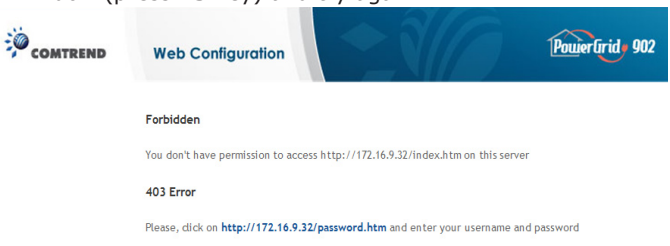
STEP 2: The login screen should appear, as shown below. Enter the login password in top section and click **OK** to continue. To perform a factory reset on the device you must enter the factory reset password in the bottom section and click **OK**. The WUI login password and other default settings can be found in section 2.3 Default Settings.



NOTE: You can change this password in the WUI (see section 5.5.4).

If you enter an incorrect password or wait too long, the

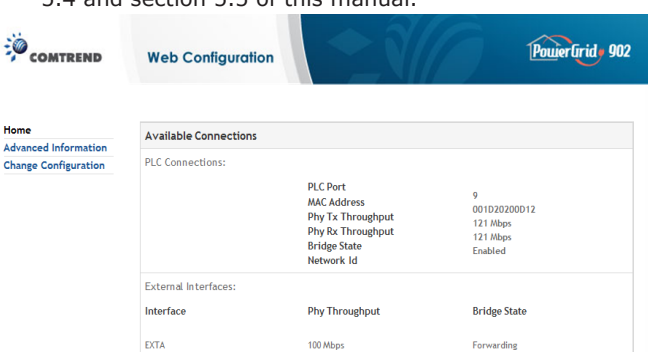
following screen will appear. In this case, refresh the browser window (press **F5** key) and try again.


COMTREND
Web Configuration
PowerGrid 902
Forbidden
You don't have permission to access http://172.16.9.32/index.htm on this server
403 Error
Please, click on http://172.16.9.32/password.htm and enter your username and password

NOTE: You will also return to the screen above if you leave the WUI unattended for too long after login. In this instance, you must login again.

5.3 WUI homepage

If login is successful, you will arrive at the WUI homepage. This screen lists the available PLC connections and External Interfaces as shown below. It also provides access to the **Advanced Information** and **Change Configuration** submenus, using the links on the far left. These submenus are discussed in detail in section 5.4 and section 5.5 of this manual.

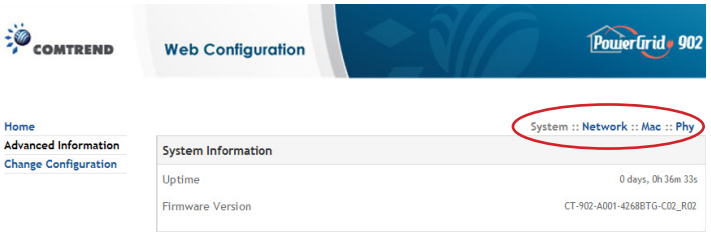


See the table below for details.

PLC Connections	
PLC PORT	The PLC data connection port
MAC Address	This is a code that identifies each PowerGrid unit. It can be found on the back label of the unit below the barcode.
Phy Tx/Rx Throughput	Physical Transmission / Reception Throughput is a measure of network bandwidth. Available data transmission capacity is roughly half this value.
Bridge State	Enabled indicates there is a data connection. Disabled indicates no data connection.
Network Id	The Network ID is used for network security. If present, the network is in FIXED AP mode.
External Interfaces	
Interface	EXTA = Ethernet
Phy Throughput	Physical Throughput = Data Transmission Capacity
Bridge State	Forwarding = Active

5.4 Advanced Information

This submenu provides more detailed information concerning your PowerGrid unit and is further subdivided into the following four screens: System, Network, Mac and Phy. These screens are accessed with links located at right (outlined in red).



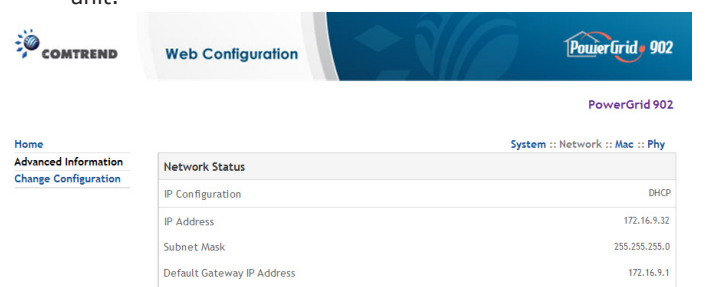
5.4.1 System Information Screen

This screen is shown above and details are provided in the table below.

Uptime	This shows the length of time the PowerGrid unit has been active.
Firmware Version	This shows the PowerGrid 902 installed firmware version.

5.4.2 Network Screen

This screen shows the TCP/IP settings for this PowerGrid unit.



NOTE: Most of this information can also be found on the **Local Area Connection Status** dialog box (see step 4 of section 4.1).

IP Configuration	Either DHCP (Automated) or FIXED IP (Manual).
IP Address / Subnet Mask	These values define the location of the PowerGrid unit on the local area network.
Default Gateway IP Address	The IP address of the router that forwards traffic to a destination that is out of reach of the PowerGrid 902 unit.

5.4.3 MAC Screen

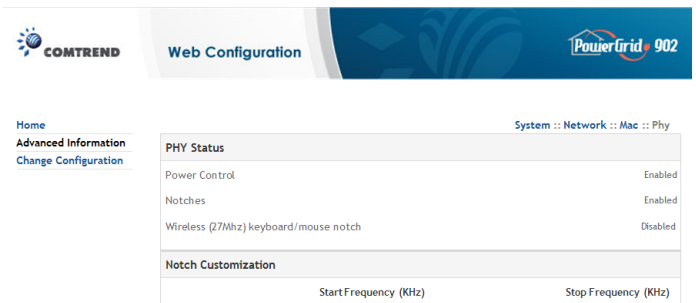
This screen provides information for identification of the AP unit (MAC Address), in addition to PowerGrid network encryption details.

MAC Address	This is a code that identifies each PowerGrid unit. It can be found on the back label of the unit below the barcode.
MAC Type	The MAC Address shown above is an In-Home AV type.
Node Type	This will show as Fixed AP, EP or AP.
Network Identifier	This field is used in Fixed AP mode to identify the network. The Network ID can be up to 20 ASCII characters long.

Encryption Key	In Fixed AP mode, it shows a key in ASCII or HEX format. In AP mode it shows as Disabled.
Encryption Type	The possibilities are 3DES or 128/256 bit AES (Fixed AP) or None (AP mode)

5.4.4 PHY Screen

This screen summarizes the physical parameters of the PLC network.

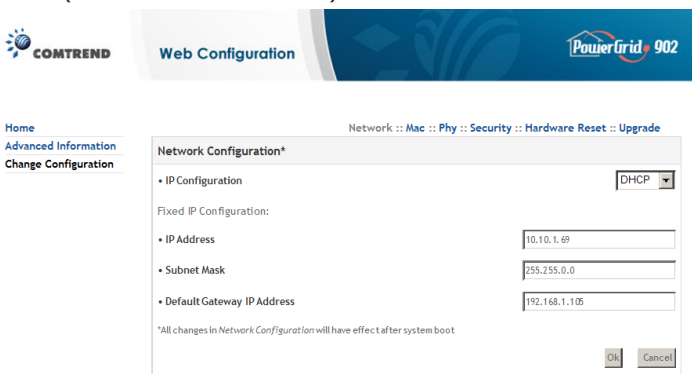


Power Control	This function minimizes the transmission power of each PowerGrid unit while maintaining data throughput performance. It is always Enabled.
Notches	Enabled (by default) and cannot be altered.
Wireless (27Mhz) keyboard/mouse notch	Disabled (by default). When Enabled, it prevents wireless keyboard/mouse signal interference.
Notch Customization	If notches have been set they will appear here.
Start Frequency (KHz)	The notch start frequency.

Stop Frequency (KHz)	The notch stop frequency.

5.5 Change Configuration

This submenu provides network configuration functions and is further subdivided into the following screens: Network, Mac, Phy, Security, Hardware Reset and Upgrade. These are accessed with links located at right (as outlined in red below).



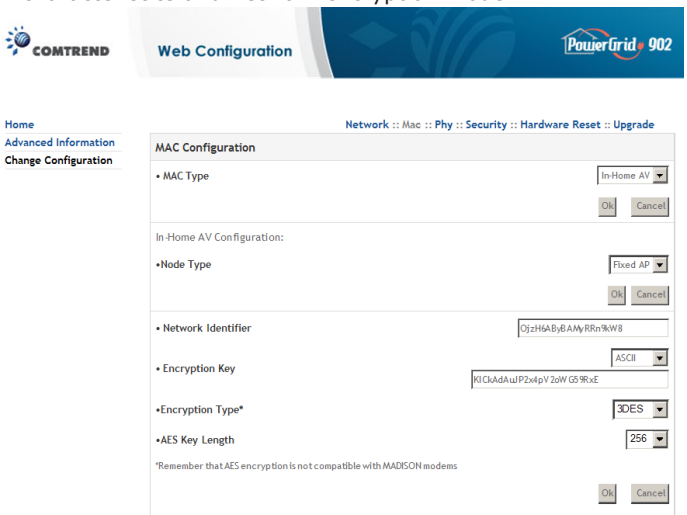
5.5.1 Network Screen

The screen shown above provides options to configure the IP configuration of this PowerGrid 902 unit. The **IP Configuration** drop-down box has two options: **DHCP** and **FIXED**. In **FIXED** mode the **IP Address, Subnet Mask** and **Default Gateway** IP Address can be set manually, while in DHCP mode they are assigned by a **DHCP** server (see section 5.1 for more details).

NOTE: Changes do not become effective until after a reboot of the PLC unit.

5.5.2 MAC Screen

This screen provides options to configure the AP unit MAC characteristics and network encryption mode.

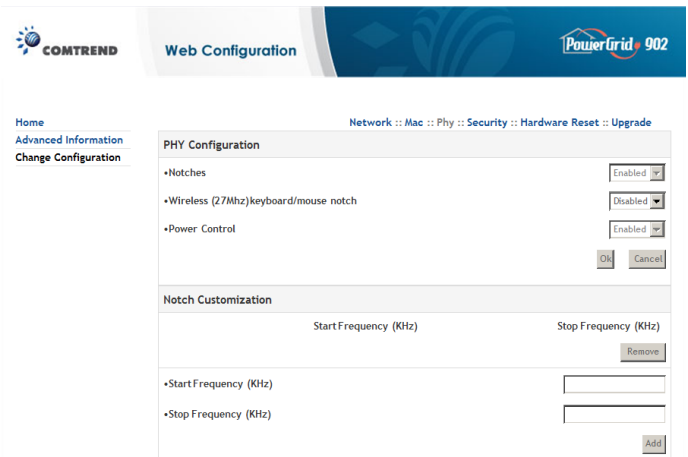


MAC Type	In-Home AV is the only option at this time.
Node Type	There are only 2 kinds of nodes either Fixed AP or EP.
Network Identifier	This field is used in Fixed AP mode to identify the network. The Network ID can be up to 20 ASCII characters long.
Encryption Key	This key, in either ASCII or HEX format, is used to encrypt the network. It is disabled in AP mode.
Encryption Type	You have the choice of 3DES or AES encryption.
AES Key Length	AES encryption can be set as 128 or 256 bit strength.

NOTES: In 3DES mode, the Encryption Key can be up to 24 ASCII characters or 42 hexadecimal numbers. In AES mode, it can be up to 8 ASCII characters or 14 hexadecimal numbers (256 bit mode). Hexadecimal encryption is stronger.

5.5.3 PHY Screen

This screen provides options to configure the physical parameters of the network.



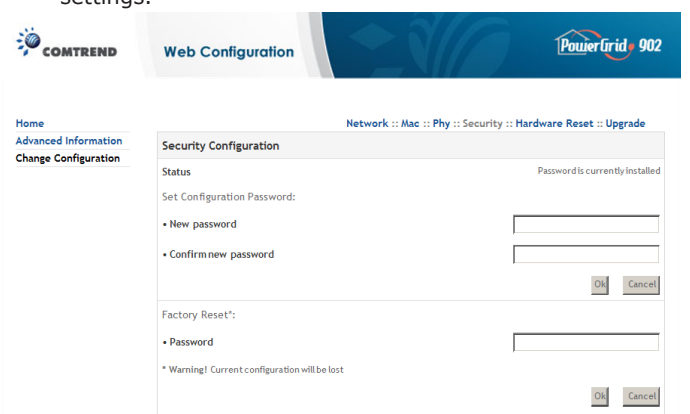
Notches	This is set to Enabled by default and cannot be altered.
Wireless (27Mhz) keyboard/mouse notch	Enable this option when using a wireless keyboard or mouse to avoid interference. It is disabled by default.
Power Control	This is set to Enabled by default and cannot be altered. It minimizes the transmission power of each PowerGrid unit while maintaining data throughput performance.

Notch Customization	Add/Remove notches in this section.
Start Frequency (KHz)	The notch start frequency.
Stop Frequency (KHz)	The notch stop frequency.

5.5.4 Security Screen

This screen allows you to change the configuration password and perform a factory reset to recover default settings. To change the configuration password, notice that you must enter it twice; first in the New password field and then again in the Confirm new password field. The password can be up to 20 text characters in length. Click OK to make this change.

To reset the device to factory settings, enter the factory reset password (see section 2.3 Default Settings) and click OK. Use this function with caution, since, as noted onscreen, this will erase the current configuration settings.



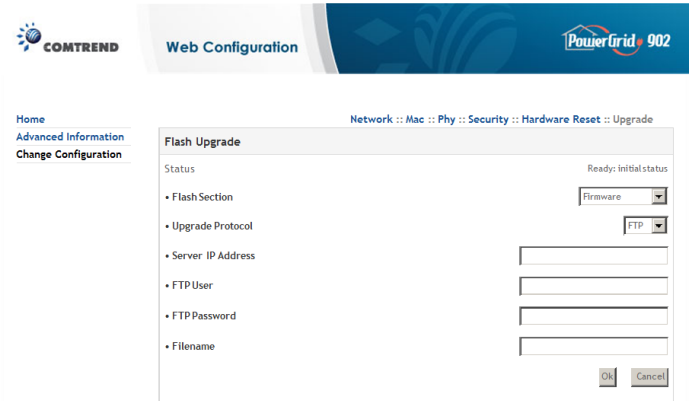
NOTE: To remove the configuration password, just click OK.

5.5.5 Hardware Reset

This screen allows for a hardware reset which will reboot the device but not erase the configuration settings. It performs the same function as holding down the Config/ Reset button on the front panel of the unit. You must perform a hardware reset of the device to enable certain settings, such as the IP mode (DHCP/FIXED).

5.5.6 Upgrade

This screen provides a method to upgrade the flash memory in the PowerGrid unit from a remote server using FTP or TFTP protocol. The flash memory is divided into three sections: the firmware, a boot-loader and the factory settings. Each of these can be upgraded separately to provide for maximum flexibility.



See the table below for more details.

Status	Reports the current status of the flash upgrade.
Flash Section	Upgrade the firmware, loader or factory settings.
Upgrade Protocol	FTP or TFTP
Server IP Address	This will be provided by your service provider.
FTP User / Password	Enter the user name and password if required.
Filename	This is the filename of the flash upgrade on the server. The firmware and loader will have a .bin extension, while factory settings are stored as .cfg files.

Chapter 6 - HELP

This PowerGrid unit has been designed to be a reliable and easy-to-use home networking device. However, should you experience any problems, please refer to the troubleshooting and FAQ sections below to resolve your issue.

6.1 Troubleshooting

FACTORY RESET

To reset a unit to factory default settings, simply press the CONFIG/RESET button for 15 seconds. The adapter will reset its configuration to factory default settings and auto-reboot. If the reboot is successful, it will be configured in EP mode. If you reset the AP unit, you will need to repeat the entire network setup process described in Chapter 3.**NETWORK SETUP**

NETWORK SETUP

1.Converting an AP unit into an EP unit:

- Make sure the PowerGrid unit is plugged directly into the electrical outlet and that it is powered on.
- Do a factory reset (see the **RESET PROCEDURE** above).

2.Converting an EP unit into an AP unit:

- Make sure the PowerGrid unit is plugged directly into the electrical outlet and that it is powered on.
- Press **CONFIG/RESET** button until its AP/STBY LED starts blinking.
- Wait until configuration period finishes (30

seconds). At that point the adapter has been designated as a Fixed AP if its AP/STBY LED is GREEN.

3. There MUST only be one Fixed AP in a network. Verify that this is the case by examining the AP/STBY LED for all adapters. If there is more than one AP in the network, it means that the key exchange process has failed.

   - Perform a factory reset on the adapter you do not wish to be designated as an AP (see step 1 above).
   - Repeat the network configuration procedure again (see Chapter 3).
   - If the configuration procedure fails again, it is possible the adapters are using different forms of encryption. For example, one might be using AES and the other 3DES. To eliminate this as a possibility, perform a factory reset on all adapters and repeat the configuration process.
   - If configuration still fails, connect a PC to each adapter, and use the WUI tool to ensure that all PLC devices have the same network ID, encryption mode and key. If not, try to configure them in electrical outlets that are nearby to avoid a communications problem. Once configured, move the adapters to their final position and test connectivity again.
   - If encryption mode is not the same in the two adapters, then the EP may not have the ability to set the AP encryption mode for regulation issues or because it is from an older generation when AES was not available. Try to put the AP in an encryption mode compatible with all PLC devices, such as 3DES encryption.

4. NETWORK PERFORMANCE

If the network is performing slowly or not at all, try the following:

- Check the ETHERNET LED on every PowerGrid 902 unit.
- If the ETHERNET LED on any unit is **OFF**, check that the PowerGrid unit is connected securely. The ETHERNET LED on every unit should be GREEN.
- Make sure that the settings of all your networked devices are correct.
- Next check the STATUS LED of every unit. If any unit has a RED STATUS LED, plug that unit into a different power outlet and wait for the STATUS LED colour to change to ORANGE or GREEN.
- If the STATUS LED of any unit remains RED after moving it to another outlet, perform a factory reset on the unit as described above.
- If there is no change, perform a factory reset on every unit, starting with the AP unit. You will then need to reconfigure the network according to the instructions in Chapter 3 - Quick Setup .

FYI:

A PowerGrid unit with a GREEN STATUS LED supports a HDTV signal (>12 Mbps), while a unit showing ORANGE can support a SDTV signal (6-12 Mbps).

NOTE: If the HDTV video bandwidth is lower than 12Mbps, it may be possible to stream the video with an ORANGE STATUS LED in some cases.

FURTHER ASSISTANCE

If this section has failed to resolve or address your issue, consult your local agent.

6.2 FAQ

The following are frequently asked questions (FAQ) and answers.

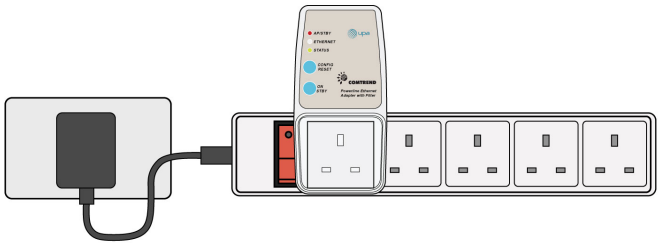
1. Do PowerGrid units work with surge protected power strips?

   There are two types of anti-surge protectors on the market in the UK. The basic models provide simple protection for a surge increase in mains voltage. More expensive models have this feature, but also include a filter which provides protection against EMI (Electromagnetic Interference) or RFI (Radio Frequency Interference).

   Every house has different wiring set ups, and it is impossible to say which anti-surge protectors will work with the PowerGrid 902 and which will not. Our test lab and user experience has shown that the more expensive strips with EMI/RFI filters are more likely to prevent the PowerGrid 902 working than the basic strips. The Status LED will show red if there is a problem.

2. What if I cannot fit my PowerGrid unit into my plug socket?

   Your PowerGrid units might not fit because the sockets are too close to the floor or are in the skirting board. The easiest way around this is to use a trailing power strip and plug the Adapter into the strip. Please make sure that the strip is not an anti-surge adapter strip, as per the previous point.



3. What if the flat next door has PowerGrid units as well?

   In this case, make sure to configure the units according to the procedure in this user manual. That way, each pair of PowerGrid units will have its own unique security key and your connection will be secure.

4. Is it safe to leave the PowerGrid units on all the time?

   PowerGrid units are CE certified and completely safe to leave plugged in all the time. They may become slightly warm in use - this is perfectly normal. However, you may wish to put them into standby mode when not in use. To do so, simply press the ON/STBY button and release.

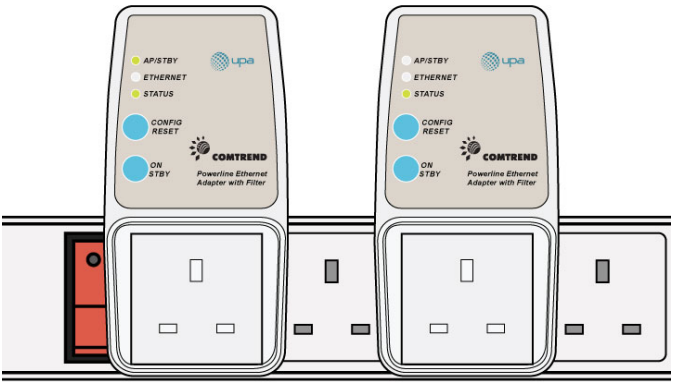
5. How much power do PowerGrid units use?

   The Adapters use 5.0 Watts when in use and 1.8 Watts in standby. Prices vary between electricity suppliers, but on average, both Adapters running all the time would cost about 9.6p a month.

6. What is the best way to check that my PowerGrid units are working properly?

   Your PowerGrid units are set to work together as a pair, and should work perfectly out of the box. The best way to test them is to find a double plug socket,

and plug them in next to each other. Often the best place to find a double plug socket is in your kitchen. Alternatively plug them into a trailing extension strip (but not an anti-surge strip). When plugged in, after 10-40 seconds, the PowerGrid units will configure themselves so that each has a GREEN STATUS LED and one of the pair has an AP/STBY LED that is GREEN.



If the PowerGrid units don't configure themselves as above, you need to follow the FACTORY RESET procedure in the Troubleshooting section.

NOTE: When your PowerGrid adapters are connected to your V-Box the Ethernet light should light up. When you're using the service the Ethernet light will flash. You may notice that the Status Light on one or both PowerGrid adapters changes to red or orange. This isn't something to worry about if you are not having any problems with your BT Vision service.

Appendix A - Acronyms

The following is a list of acronyms referenced in this manual.

Acronym	Expanded
3DES	Triple DES
AES	Advanced Encryption Standard
AP	Access Point
DES	Data Encryption Standard
EP	End Point
HDTV	High Definition TV
ISP	Internet Service Provider
PC	Personal Computer
PLC	Powerline Communications
SDTV	Standard Definition TV
STB	Set Top Box
WUI	Web User Interface

COMTREND